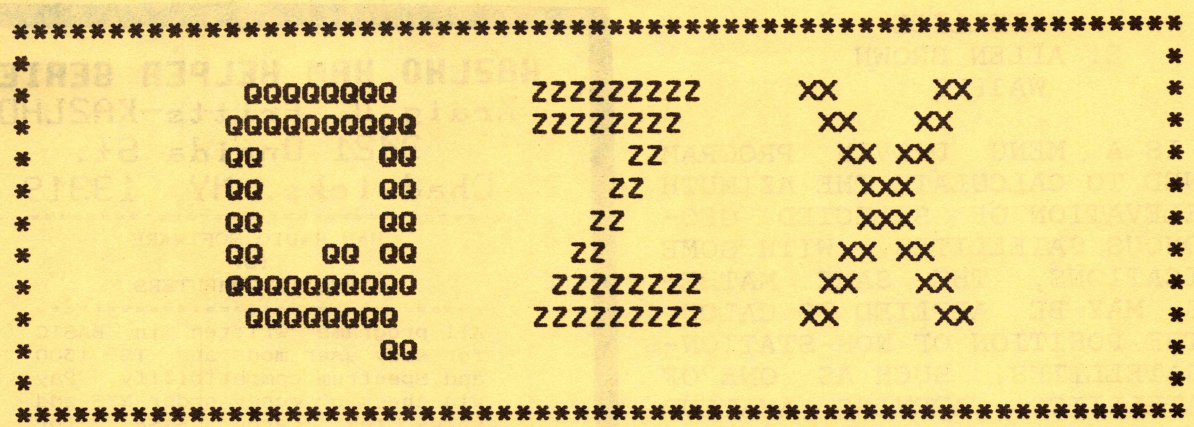

The Journal Covering Amateur Radio & Sinclair Computers
ZX-80; Micro-Ace; ZX81; T/S 1000, 1500, & 2068
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88001

K5XY
Alex. F. Burr
Publisher

W4GHV/5
Bo Barry
Editor

Volume 3 Number 6 ($1.50/issue) May 1985

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NOTES

Alex is off to 'Bangle Dishes' again (I never can spell it rite!). Bo is off to good ol' Morganton, NC to swat mosquitoes and relax a bit. June QZX goes to the print shop on June 4th and will be mailed out upon Bo's return on June 28th.

T - S Horizons Magazine

On the way to me are 100 sample copies of this excellent magazine for Timex/Sinclair owners. If you aren't familiar with it, drop me a postcard and I'll gladly send a copy along to you.

SATELLITE
E. ALLEN BROWN
WA3FYZ

THIS IS A MENU DRIVEN PROGRAM DESIGNED TO CALCULATE THE AZIMUTH AND ELEVATION OF SELECTED GEO-SYNCRONOUS SATELLITES. WITH SOME MODIFICATIONS, THE SAME MATHE-MATICS MAY BE APPLIED TO CALCU-LATE THE POSITION OF NON-STATION-ARY SATELLITES, SUCH AS ONE OF THE SATELLITES CARRYING AMATEUR RADIO.

LINES 110-500 MAY BE MODIFIED AS NEW SATELLITES ARE LAUNCHED INTO ORBIT OR AS OLD SATELLITES REACH THE END OF THEIR USEFUL LIFE.

THE LATITUDE AND LONGITUDE OF THE EARTH STATION MUST BE KNOWN AND THE PROGRAM IS WRITTEN SO THAT IT ONLY WORKS IN THE WESTERN HEMI-SPHERE NORTH OF THE EQUATOR. ALTHOUGH THESE FIGURES ARE COM-PUTED TO HUNDREDTHS OF A DEGREE, IN REALITY, SMALL DEVIATIONS MAY BE NOTED FROM COMPUTED FIGURES. THESE MAY BE ATTRIBUTED TO FRESNEL EFFECTS, ESTIMATIONS OF CONSTANTS IN THE PROGRAM, OR A LOSS OF ACCURACY IN THE CONVER-SION FROM DEGREES TO RADIANS AND BACK TO DEGREES, AMONG OTHERS.

THE AZIMUTH OR BEARING FIGURES ARE IN DEGREES FROM GEOGRAPHIC NORTH AND MAGNETIC DEVIATIONS AT EACH SITE MUST BE CONSIDERED IF A MAGNETIC COMPASS IS USED TO FIND DIRECTION. ELEVATION IS IN DEGREES ABOVE THE HORIZON AT SEA LEVEL.

ALSO NOTE THAT ANY EARTH STATION NORTH OF ABOUT 81.3 DEGREES LATITUDE CANNOT SEE ANY OF THE GEOSYNCRONOUS SATELLITES, BUT THERE AREN'T VERY MANY PEOPLE THERE ANYWAY.

NATURALLY, THE ACCURACY OF THIS PROGRAM CANNOT BE GUARANTEED AND COMMERCIAL USE IS PROHIBITED.

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==========

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==========

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==========

CompuServe User ID #74676,3320

```
  1 REM THIS PROGRAM WILL HELP
  2 REM FIND THE AZIMUTH AND
  4 REM ELEVATION OF GEOSYNC
  5 REM SATELLITES GIVEN THE
  6 REM WEST LONGITUDE AND
  7 REM NORTH LATITUDE OF THE
  8 REM EARTH STATION. NO
  9 REM GUARANTEE OF ACCURACY
 10 REM IS EITHER EXPRESSED OR
 11 REM IMPLIED AND COMMERCIAL
 12 REM USE OF THIS PROGRAM
 13 REM WITHOUT PERMISSION IS
 14 REM PROHIBITED.
 15 REM
 16 REM E. ALLEN BROWN, WA3FYZ
 17 REM 8645 TOWER DRIVE
 18 REM LAUREL, MD. 20707
 18 REM
 19 REM
 20 REM
 21 REM   V.2.L      4/29/85
 22 REM
 23 REM
 24 REM    ENTER RUN TO BEGIN
 25 PRINT AT 4,0;"GIVEN THE WES
T LONGITUDE AND    NORTH LATITUD
E OF A PARTICULAR  EARTH  STATIO
N,. THIS PROGRAM    WILL COMPUTE
THE AZIMUTH        (BEARING) AND
 ELEVATION ANGLE TOORIENT AN ANT
ENNA WITH A NARROW BEAM WIDTH TO
 RECEIVE ANY OF THELISTED GEO-SY
NCRONOUS SATELLITES"
 26 PRINT AT 17,5;"TO BEGIN-PRE
SS ANY KEY              (EXCEPT
BREAK)"
 30 IF INKEY$=" " THEN GOTO 50
 40 PAUSE 3000
 50 CLS
 60 FAST
 70 PRINT AT 0,0;"  SELECT THE
DESIRED SATELLITE"
 80 DIM A(25)
 90 DIM A$(20,32)
100 LET N=1
110 LET A$(1)="AURORA I"
120 LET A(1)=143
130 LET A$(2)="ANIK B"
140 LET A(2)=109
150 LET A$(3)="ANIK C2"
160 LET A(3)=105
170 LET A$(4)="ANIK D"
180 LET A(4)=104.5
190 LET A$(5)="ANIK III"
200 LET A(5)=114
210 LET A$(6)="COMSTAR I / GALA
XY I"
220 LET A(6)=128
230 LET A$(7)="COMSTAR II / SBS
III"
240 LET A(7)=95
250 LET A$(8)="COMSTAR III"
260 LET A(8)=87
270 LET A$(9)="COMSTAR IV"
280 LET A(8)=127
290 LET A$(10)="GALAXY II"
300 LET A(10)=74
310 LET A$(11)="SATCOM I-R"
320 LET A(11)=139
330 LET A$(12)="SATCOM II-R"
340 LET A(12)=72
350 LET A$(13)="SATCOM III-R"
360 LET A(13)=131
370 LET A$(14)="SATCOM II"
380 LET A(14)=119
390 LET A$(15)="SATCOM IV"
400 LET A(15)=83
410 LET A$(16)="TELSTAR 301"
420 LET A(16)=96
430 LET A$(17)="WESTAR I / WEST
AR IV"
440 LET A(17)=99
450 LET A$(18)="WESTAR II"
460 LET A(18)=79
470 LET A$(19)="WESTAR III"
480 LET A(19)=91
490 LET A$(20)="WESTAR V"
500 LET A(20)=123
600 PRINT AT N,0;N;TAB 3;A$(N);
AT N,25;A(N);" W"
610 LET N=N+1
620 IF N=21 THEN GOTO 640
630 GOTO 600
640 PRINT "    ENTER A NUMBER (
1 TO 20)"
650 INPUT S
660 IF S>20 OR S<1 THEN GOTO 65
0
680 LET SAT=A(S)*PI/180
690 LET Z$=A$(S)
700 CLS
1000 PRINT "ENTER YOUR LATITUDE
NORTH OF THEEQUATOR"
1010 PRINT
1020 PRINT "IF THE LATITUDE AND
LONGITUDE   ARE THE SAME AS THE
PREVIOUS    COMPUTATION, ENTER 1
00."
1030 PRINT
1040 PRINT "INPUT DEGREES LATITU
DE"
1050 INPUT DEGLAT
1060 IF DEGLAT=100 THEN GOTO 2000
1070 LET D1=DEGLAT
1080 PRINT D1
1090 PRINT "INPUT MINUTES"
1100 INPUT M1
1110 PRINT M1
1120 PRINT "INPUT SECONDS"
1130 INPUT S1
1140 PRINT S1
1150 LET K1=ABS (D1)+(M1/60)+(S1
/3600)
1160 LET LAT=K1*PI/180
1170 IF LAT=0 THEN LET LAT=0.000
0001
1180 CLS
1190 PRINT "ENTER YOUR LONGITUDE
 WEST OF THEPRIME MERIDIAN"
1200 PRINT
1210 PRINT "ENTER DEGREES LONGIT
UDE"
1220 INPUT D2
1230 PRINT D2
1240 PRINT "ENTER MINUTES"
1250 INPUT M2
1260 PRINT M2
1270 PRINT "ENTER SECONDS"
1280 INPUT S2
1290 PRINT S2
2000 LET K2=ABS (D2)+(M2/60)+(S2
/3600)
2010 LET LONG=K2*PI/180
2030 LET Z=ABS (SAT-LONG)
2040 IF Z=0 THEN LET Z=0.000001
2050 IF Z>PI THEN LET Z=ABS (2*P
I-Z)
2060 LET D=COS LAT*COS Z
2070 LET D=-ATN (D/SQR (-D*D+1))
+PI/2
2080 LET J=((-SIN (LAT))*(COS D)
/(COS (LAT)*SIN D))
2099 REM 1 RAD=57.29577951 DEG.
2100 LET AZ=(-ATN (J/SQR(-J*J+1
))+PI/2)*57.29577951
2110 IF AZ>LONG AND AZ<(PI+LONG)
 OR AZ>(2*PI+LONG) THEN LET AZ=3
60-AZ
2120 LET E=(PI/2-(ATN (26203.8*S
IN D/(26203.8*COS D-3958.75))))*
57.29577951
2130 LET E=INT (E*100)/100
2140 LET AZ=INT (AZ*100)/100
2145 IF LONG>SAT THEN LET AZ=180
-(ABS (AZ-180))
2150 CLS
2160 PRINT "STATION LOCATION:"
2170 PRINT
2180 PRINT D1;" DEG";M1;" MIN";S
1;" SEC  N LAT BY"
2190 PRINT
2200 PRINT D2;" DEG";M2;" MIN";S
2;" SEC  W LONG"
2210 PRINT
2220 PRINT "SATELLITE: ";Z$
2230 PRINT
2240 IF D>=1.418952682 THEN GOTO
 2370
2241 REM 1.418952682RAD=81.3 DEG
2250 PRINT
2260 PRINT "AZIMUTH: ";AZ;" DEG
TRUE"
2270 PRINT
2280 PRINT
2290 PRINT "ELEVATION: ";E;" DEG
"
2300 PRINT
2310 PRINT
2320 GOSUB 2440
2330 PAUSE 4E4
2340 CLS
2350 GOTO 50
2360 PRINT
2370 PRINT "CANNOT BE RECEIVED B
ECAUSE IT"
2380 PRINT
2390 PRINT "IS BELOW THE HORIZON
."
2400 GOSUB 2440
2410 PAUSE 4E4
2420 CLS
2430 GOTO 50
2440 PRINT AT 20,0;"TO COMPUTE A
NOTHER, PRESS ANY   KEY EXCEPT B
REAK."
2450 RETURN
9000 SAVE "SATELLITE"
9010 RUN
```

A TI KEYBOARD FOR YOUR T/S

Alex. F. Burr K5XY

The membrane keyboard on the Sinclair and Timex computers is compact and inexpensive, but it is impossible to touch-type with it, and it is difficult to use on CW and RTTY. Recently there have been a lot of Texas Instruments TI-99/4A keyboards appearing on the surplus market at very reasonable prices. Even Radio Shack has been carrying them, often at prices lower than the surplus houses. Many readers are interested in adapting these keyboards to their Timex or Sinclair computers.

First, a bit about the Sinclair keyboard. The fourty keys are divided up into eight groups of five keys each. The figure gives a schematic of the arrangement. A key closure connects one of the eight horizontal lines to one of the five vertical lines. (Note, each verical line comes in two parts on the figure.) Each switch must be a SPST switch to make this connection. (This is why some capacitor and other switch types do not work.)

Now a word or so about the TI keyboard. These keyboards once cost up to $120 each. They have 48 typewriter style keys including a real live space bar. These keys have sculptured tops and a firm, full stroke touch. The size is closer to regular typewriter spacing too. Fortunately, the keys are SPST and they are even connected in the same manner as the T/S keyboard, almost. The TI used a scheme similar to the T/S way of doing things. Unfortunately, TI did not group the keys in exactly the same way. Fortunately, the trace cutting and rewiring required is not very hard.

All TI boards may not be exactly the same, but the following steps will work for the type with which I am most familiar. In any case, the goal is to wire the keyboard so it looks like the figure. All the horizontal traces except those to the B, shift, and space keys on the TI keyboard match the T/S matrix. All the vertical traces match also except those to the bottom keys and the space and shift keys. Unfortunately, in rewiring each bottom row key every link between the vertical traces of the left and right halves of the keyboard must be cut. Fortunately, only five jumpers between top row keys are needed to restore the links.

To rewire the keys first turn the keyboard over so the lettering on the solder side is facing you right side up as you work. The traces can be cut with a sharp knife but the copper is fairly thick. Be careful not to nick or cut nearby traces. Make the cuts wide enough so that the traces remain cut.

Cut all traces to both ENT points (the pair farthest left on the keyboard). Cut the outside (left most) trace also at this location. On the righthand side of the keyboard, cut the trace above the right most SH point. Cut all the traces to both B points. Mote that these lie below and to the right of the letter B, not the one to the left of it. Cut all the traces to both AL points.

Now note that one set of the solder points for the bottom row keys is tied together horizontally. Do not cut these traces, but isolate each of the other set of points for this bottom keyrow from its vertical traces. Remove the ribbon cable from the 15 points at the top of the keyboard and identify these points by numbering them from 1 to 15 from left to right. This operation completes the necessary disconnections.

Now for the connections. Prepare to connect your TI keyboard to your computer by making five leads of one color and eight of another. Solder one end of the five vertical leads to each of the points 1, 2, 3, 7, and 8. Solder seven to the eight horizontal leads to points 5, 6, 9, 12, 13, 14, and 15. Solder a lead from the point marked SP to point 11. Solder the eighth computer connection lead to point 11 also.

Note which top row points are linked horizontally, and tie the other (vertical) points by soldering jumpers between the keys 5 and 6, 4 and 7, 3 and 8, 2 and 9, and 1 and 0. Jump the left-most ENT to the left P. Jump the other ENT to the horizontal L. Jump the right-most SH (right side of the keyboard) to the horizontal Z. Jump the other right SH point the vertical A. Jump the point just below the letter B to the horizontal N. Jump the other B point to vertical V and also to vertical G. Then complete all the vertical jumps Z to S, X to D, C to F, N to J, M to K, and "," to L. Jump both AL points in parallel to both SH points. This operation completes the rewiring.

Now you have to decide how you want to connect your board to your computer. Some people wire it in permanently, some through a plug and socket. Some leave the old keyboard in parallel with the new and some just discard the old one. If the old one is kept, be careful not to disturb the original connections to the circuit board. Either connect the plug or the

direct wires as follows.

On the lower left corner of the solder side of the computer printed curcuit board is a row of eight solder points marked 8 to 1. Label these left to right as A through H. Label the row of five points to the right of these similarly as I through M. Now connect your keyboard leads (or plug wires) so that the lead from the keyboard number connects to the appropriate computer letter. The pairs to be connected are 1 to L, 2 to K, 3 to J, 5 to C, 6 to G, 7 to M, 8 to I, 9 to H, 11 to A, 12 to B, 13 to E, 14 to F, and 15 to D. You now have a new keyboard for your T/S computer.

You also have eight extra keys which you can put to use. For instance, you can make a very useful shift lock key by cutting all the traces to the ALPHA LOCK key on the new keyboard, and then rewiring it by running a pair of jumpers to the SHIFT key. You can use the other keys as you see fit. (By running two extra wires, one will make a nice reset key.)

In any case with a reasonable amount of work and one of these surplus keyboards, you will have made you T/S computer much easier to use on CW and RTTY. Have fun.

RTTY and SLOW SCAN EQUIP
Bob Howard WA6LDI

Well, today was Christmas in May! You see today when I arrived home from work, I found two packages. One, from Curry Computer, was my Tasman Parallel Interface that I needed to operate my new (used) Mannesmann Talley "Spirit" 80 printer. The second package was from Sweden and contained all the desires that one with a Spectrum could want for ham radio. The recent ad that ran in QZX from "Chara Electronics" by SM3HBQ, Hans p Eckert, had spurred me to order the whole outfit. I had already made my 2068 "Spectrum" compatable by obtaining a "Z-Link" Interface which makes the rear edge connector into a Spectrum edge connector including the new voltages and contact arrangement to operate such things as the Nicrodrives. I also had the Doug Dewey "Chameleon" ROM Emulator for the cartridge port.

The items that I received (only 11 days after my check was received in Sweden) were an RTTY Interface with software, a CW program to work also with the interface, if I build a tone decoder circuit that was furnished. (I nay be able to use a TU unit instead). The third item was the most fascinating.... a SLOW SCAN decoder for TV pix as sent by the amateurs on SCTV transmissions. I have been saving some tapes made of the Voyager Mission off the air from JPL.

With the 2068 off, I connected the two interfaces and plugged the mysterious PFU (Program Feedback Unit) on the 'Z-Link rear connector. I then played the program tape into the 2068 and admired the nifty title page showing a TV, Microphone, and Ham rig. Credit in the title is G1FTU, Janes Pearson, program author. All the programs are English from "SCARAB SYSTEMS", which should account for any "bugs" found.

The next step, when the menu appeared, is to press "I" and play the demo tape into the system to see your first SCTV pix. On pressing the "I" the menu disappeared and suddenly trom the memory a lady's face flashed on the screen...a SLOW SCAN inmage that would probably be erased from the buffer as you added a new one by playing the tape or feeding your receiver SCTV signal into the ear jack. At this stage of the experiment the program crashed. I reloaded the tape and took pictures of all the screens obtained, including the lady which only is on about a half second. As soon as I can find the culprit causing the crash, I will report further. It will probably be a need to CLEAR to a specific address. The encouraging thing is that the picture I got was quite good even it it had come from a Euopean TV standard.

PUBLISHER'S NOTES

The Sinclair computer scene is looking up. In fact the T/S 2068 is back, or rather a hybrid of the old T/S 2068 and the Spectrum + is now on its way from Portugal. Basically it is the T/S 2068 with the Spectrum port on the back.

We could still do with some more subscribers. Some are helping by mentioning us on the air and on bulletin boards. Also be sure to mention QZX when you write to or buy something from those who advertise here. Some, like the Research Service Labs which had an ad last month, even offer a special discount to QZX readers.

SOME NET INFO

QZX Net .. Wednesdays, 9 PM EDT; 14.345 MHz with NV4F as NCS.
Eastern Regional Sinclair Net .. Sundays, 1600 Z; 7.245 MHz with KQ2F as NCS.

COMPUTER SERVICE

TS Connection (3832 Watterson, Cincinatti, OH 45227) has taken over the Timex computer factory repair service previously offered by Timex in Little Rock, AR. They will repair a T/S 1000 for $20 maximum, and a 2068 for $40 max. The 2068 Tech Manual is also carried by TS Connection. If your computer is on the fritz, write to them at the address mentioned above, or call (513) 271-5575.

QZX FRIENDS

KH6AFM -- Ray renewed for "another year of good reading".

W1SPP -- Ed writes about some of his medical problems which have kept him off the net. He says that he has two ZX-81's, two Sinclair printers, two T/S 1000's, and two standard keyboards. He also has a library of at least 40 books and back issues of many of the important Timex magazines. I expect that he would try to help provide information to readers who clearly request it.

KA8RNY -- Bill has a new FT-757 GX Yeasu and would like any information that anybody has on hooking it up to the 2068 for CW.

C. E. Fairbank has a good chess program for the T/S 2068 which has used the sound generating capabilities of the computer to produce recognizable spoken words, quite a programing feat.

UNCLASSIFIED ADS

WANTED: UNCLASSIFIED ADS for publication in QZX. Cost is 1 cent for each keystroke (characters, blanks, etc.). Payment must be included with order. This is an excellent way to sell your program or unwanted equipment, ask for help, or find a specific program. Send your ad with payment to QZK, 2025 O'Donnell, Las Cruces, NM 88001.

FOR SALE: MORSE CODE TRANSLATOR. TS1000/TS1500/ZX81 version: Code received through "ear" jack is scrolled across screen - NO EXTRA HARDWARE NEEDED. Also generates code from strings, $9.95 + $1.00 S&H. TS2068 version: Same as above but with more features like type ahead buffer and hardcopy from TS2040 printer. $15.95 + $1.00 S&H. THOMSON SOFTWARE, PO BOX 1266, LOMBARD, IL 60148.

FOR SALE: Plastic strips to allow QZX to easily be placed in a three ring binder. Twelve reusable strips $3 postpaid. See Mr 85 issue for more details. Alex. F. Burr, K5XY, 2025 O'Donnell, Las Cruces, NM 88001.

WANTED: Micro Ace Computer. Working condition. Edward L Gadtke, 1602 Wookluck Ave, Louisville, KY 40205.

QL FLASH

It is reported that the QL is NOW available from the American Express for $499.95 + $8 shipping + sales tax. To order call 1-(800) 528-8000.

CQ Field Day, The Easy Way
Dave Blankenship

Have you run out of uses for your trusty Timex/Sinclair? How about a Field Day automatic CQ caller? Or perhaps a nifty way to call the maid in hopes of getting delivery of a cup of coffee?

Following is an economical speech synthesizer project that was done in order to earn an "A" in Professor Bo Barry's Special Projects Class. He didn't get to keep the project THIS time, I footed the bill for everything! The interface circuitry was based upon the articles that appeared in Radio-Electronics magazine a while back. If more info is needed on that project, send a long SASE (to Bo) and I'll gladly send it. In addition to the speech synthesizer, I also built an electronic thermometer and a battery backup real time clock. Unfortunately, the semester finished before I got the clock working.

Details of speech synthesis will not be given here. (Bo has lots of info if you need it) Basically, the SP0256 (available at Radio Shack) models the vocal tract electronically. It can create 59 distinct sounds and by putting them together you can create an unlimited vocabulary. The chip can also be connected to ROMs containing a set of words, which it speaks VERY clearly. Following is the report that was submitted to Bo.

DESCRIPTION

The project that I chose to build was an SP0256 speech processor that could be interfaced to a Timex/Sinclair 1500 computer. The idea for the interface itself, including schematics, was taken from the July, August, and September 1984 issues of Radio Electronics magazine. The schematic and machine language program that allowed me to use the speech processor was modified from both Radio Electronics, and the technical data sheet for the SP0256.

In order to interface the speech processor to the Sinclair, I first had to build the interfacing circuit shown in figure 1. This was accomplished with six integrated circuits, a card edge connector, several feet of 30 gage wire, and a small piece of breadboard.

The Sinclair has an edge card on the back side of the computer with 44 connections. This gives access to all of the pins of the Z-80 microprocessor. Since using this edge card directly affects what happens to the microprocessor, timing and buffering proved to be very crucial.

Another problem with interfacing to the Sinclair is that there are two things that must be remembered when using machine language subroutines. 1)If you use the OUT instruction with an odd device code, the monitor system will crash. 2)If you use the IN instruction with an even device code, the top two data bits (D7 and D6) will be ignored. These two characteristics can be quite troublesome if they are not known.

THE INTERFACE CIRCUIT

The schematic of the interface circuit is shown in figure 1. This is how it works. Two sections of a quad OR gate (IC1) receive three control signals from the computer (WR, RD, and IORQ). It decodes these three signals such that when WR and IORQ are low, an OUT control pulse is generated. When RD and IORQ are low, an IN pulse is generated. These input and output signals initiate the data transfers. Each of the control pulses goes to a 74LS138 3-to-8 line decoder (IC3 and IC4). The 74LS138 inputs are connected to A2, A3, and A4 of the Sinclair's address bus. This means that-assuming that A0, A1, A5, A6, and A7 are all logic low, that the device codes shown in fig.3 can be generated by the computer and be decoded by the 74LS138. IC2 and IC5 are both very important. They are bus buffers that protect the computer from damage resulting from wiring errors in the interface circuit. IC2 (74LS373) buffers the address lines and is unidirectional, while IC5 (74LS245) buffers the data bus and is bidirectional. The 74LS245 allows data to flow from the data bus to the interface circuit on all OUT instructions. But it only allows information to flow from the interface circuit to the computer on certain IN instructions. These IN instructions are determined by the IN address lines A2 through A4, and a decoder circuit constructed of IC6 and IC1. This buffer is used to interface the speech processor to the computer.

THE SPEECH PROCESSOR

Once I had the interfacing circuitry built and tested, I was ready for the speech circuit. The particular application that I chose to incorporate into my circuit required only six (6) address lines, one output line, and one input line. This allows the user to address all of the 59 allophones plus five pauses, for a total of 64 locations.

The speech processor circuits consists of a General Instrument SP0256 speech processor, an LM386 audio amp, a small speaker, a 3.12 MHz crystal, and several resistors and capacitors. The SP0256 connects directly to the interfacing circuitry, with only two signals necessary to control the circuit's operation. An OUT (18) device code pulse loads the SP0256 with the address of the allophone to be addressed. An IN (14) device code pulse is used as an input to the computer to monitor the speech sequence.

The volume of the speaker is set via potentiometer R1.

The software needed to operate the speech processor circuit is as follows:

MACHINE CODE SUBROUTINE

MACHINE CODE	MNEMONICS
DB 14	IN (14),A
E6 01	AND 01
CA 5020	JP Z, 2050
06 20	LD B,20
0E 67	LD C,67
0A	LD A,(BC)
D3 18	OUT A,(18)
C9	RET

BASIC PROGRAM

```
20  LET A$=""
30  IF A$="" THEN INPUT A$
40  LET B$=A$(1 TO 2)
50  LET A$=A$(3 TO)
60  LET A=VAL B$
70  POKE 8295,A
80  LET B=USR 8272
90  GOTO 30
```

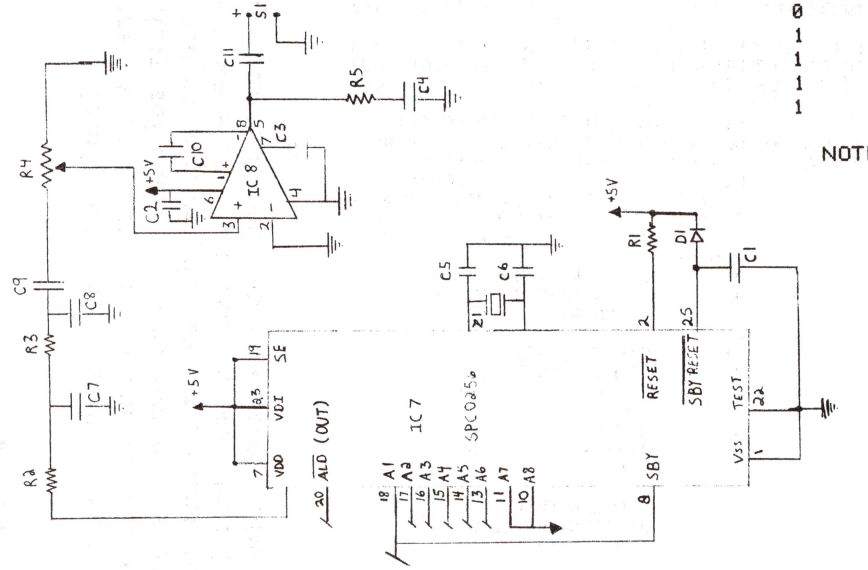
Line 20 of the BASIC program sets the string variable "A" (which represents the numerical value of the word or phrase that the SP0256 will be asked to speak) to zero. (A complete listing of the 64 allophones and their respective addresses is shown in Fig.5) Line asks the user to input the addresses of the allophones into the string. Lines 40 thru 70 manipulate the string variable "A" by some simple string slicing, and poke the first value into memory location 8295, where it will later be retrieved by the machine language subroutine that is called by line 80.

The first three instructions of the machine-language program repeatedly check the SBY (STANDBY. a logic 1 output indicates that the SP is inactive and a new address can be loaded) output of the speech processor to determine if a speech sequence has ended. This is done by generating an input device code pulse (IN A,14), setting all the bits of the accumulator to a logic 0 except D0 (AND 01), and asking the computer if D0 is a logic 1 or a logic 0 (JP Z,2050). If D0 is a logic 0, program execution returns to the beginning of the machine-language routine. If D0 is a logic 1, which means that the speech sequence has ended, the numerical value of the next allophone to be addressed is retrieved from memeory location 2067H (8295), where it was previously stored by the basic routine. That's accomplished with the instructions: LD B,20 , LD C,67 , and LD A,(BC). Once the numerical value of the allophone is in the Z80, it is transferred to the SP by the instruction OUT (18),A.

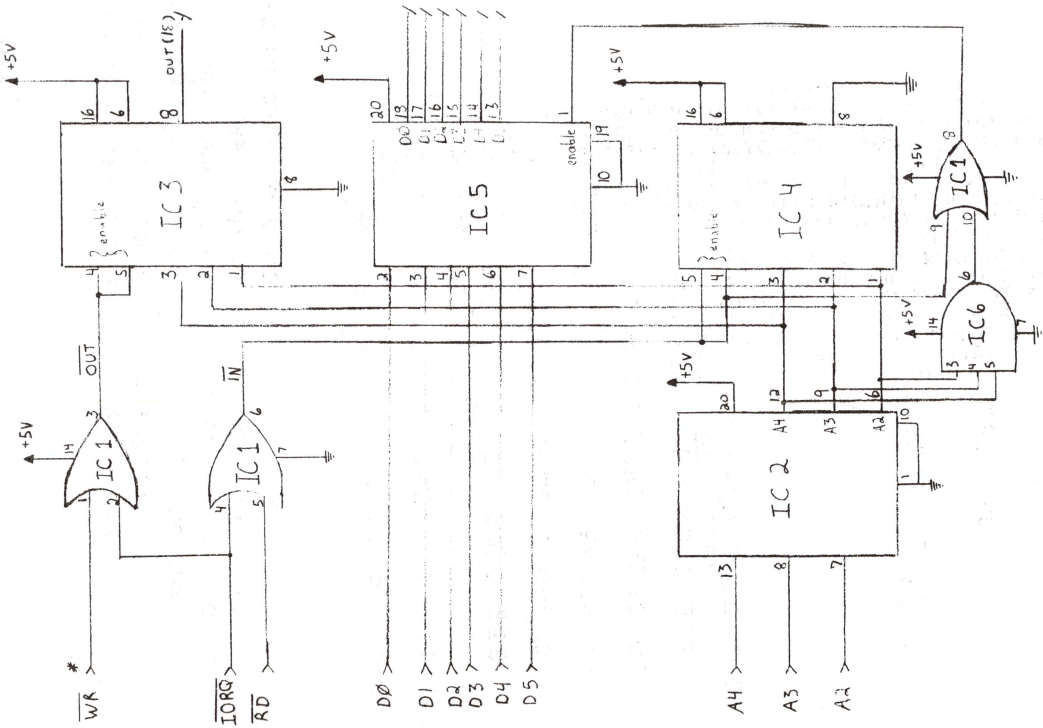
With the data transferred to the SP, the speech sequence starts automatically. Program execution returns to the BASIC program in line 90, which repeats the whole process again, until the string variable "A" is equal to zero.

SPEECH PROCESSOR (FIG2)

SCHEMATICS (FIG.1, AND FIG.2)



INTERFACE CIRCUITRY (FIG 1)



*ALL LINES WITH A ">" ARE TAKEN FROM THE COMPUTER EDGE CARD

A4	A3	A2	DEVICE CODE (HEX)
0	0	0	00
0	0	1	04
0	1	0	08
0	1	1	0C
1	0	0	10
1	0	1	14
1	1	0	18
1	1	1	1C

NOTE: A7, A6, A5, A1, AND A0 =0

PARTS LIST

Integrated Circuits

IC1	74LS32	quad OR gate
IC2	74LS373	octal D-type latch
IC3	74LS138	3-to-8-line decoder/multiplexer
IC4	74LS138	3-to-8-line decoder/multiplexer
IC5	74LS245	octal bus tranceiver
IC6	74LS11	triple 3-input AND gate
IC7	SPC0256	NARRATOR speech processor
IC8	LM386	audio amplifier

Capacitors

C1	.1-uf	ceramic disk capacitor
C2	.1-uf	ceramic disk capacitor
C3	.1-uf	ceramic disk capacitor
C4	.1-uf	ceramic disk capacitor
C5	22-pf	ceramic disk capacitor
C6	22-pf	ceramic disk capacitor
C7	.022-pf	ceramic disk capacitor
C8	.022-pf	ceramic disk capacitor
C9	1-uf	electrolytic capacitor
C10	10-uf	electrolytic capacitor
C11	100-uf	electrolytic capacitor

Resistors

R1	100k	1/4 watt, 5% resistor
R2	33k	1/4 watt, 5% resistor
R3	33k	1/4 watt, 5% resistor
R4	10k	single turn potentiometer
R5	10 ohm	1/4 watt, 5% resistor

Other

D1	1N914	low voltage diode
Z1	3.12MHz	crystal oscillator
S1		small 8 ohm speaker

EVALUATION

I found this project to be a very interesting learning experience. I not only gained experience wire-wrapping and soldering, but also in troubleshooting and writing software. I found two errors on the schematics that I was using, and they caused me alot of grief before I found them. They were, however, easy to correct- so there were no extra expenditures that I had to make. All in all, I would say that this project is well worth anyone's time that chooses to build it.

```
  10 FAST
  20 DIM A$(64*4)
  30 DIM Z$(64,3)
  35 LET LENGTH=500
  40 DIM S(LENGTH)
  50 LET A$="PA1,PA2,PA3,PA4,PA5
,OY ,AY ,EH ,KK3,PP ,JH ,NN1,IH
,TT2,RR1,AX ,MM ,TT1,DH1,IY ,EY
,DD1,UW1,AO ,AA ,YY2,AE ,HH1,BB1
,TH ,UH ,UW2,AW ,DD2,GG3,VV ,GG1
,SH ,ZH ,RR2,FF ,KK2,KK1,ZZ ,NG
,LL ,WW ,XR ,WH ,YY1,CH ,ER1,ER2
,OW ,DH2,SS ,NN2,HH2,OR ,AR ,YR
,GG2,EL ,BB2"
  60 FOR I=1 TO 64
  70 FOR J=1 TO 3
  80 LET Z$(I,J)=A$((I-1)*4+J)
  90 NEXT J
  95 NEXT I
 160 LET L=0
 170 LET P=1
 180 LET M=0
 190 LET B=8272
 290 REM :MAIN PROGRAM LOOP
 300 GOSUB 2000
 315 INPUT I$
 317 LET LN=1
 320 IF I$="" THEN GOTO 3000
 330 IF I$="E" THEN STOP
 340 IF I$="L" THEN GOTO 400
 350 IF I$="R" THEN GOTO 500
 360 IF I$="D" THEN GOTO 600
 370 IF I$="I" THEN GOTO 700
 372 IF LEN I$=1 THEN GOTO 900
 375 IF I$(2)="," THEN GOTO 5000
 380 GOTO 600
 400 REM :MOVE LEFT
 410 IF P<LN+1 THEN GOTO 900
 420 LET P=P-LN
 430 GOTO 300
 500 REM :MOVE RIGHT
 510 IF (P>L-LN+1) OR (P>LENGTH-
1) THEN GOTO 900
 530 LET P=P+LN
 540 GOTO 300
 600 REM :DELETE ALLOPHONE
 610 IF P>L THEN GOTO 300
 620 FOR I=P TO L
 630 LET S(I)=S(I+1)
 640 NEXT I
 650 LET L=L-1
 660 GOTO 300
 700 REM :TURN ON INSERT MODE
 710 LET M=1
 720 GOTO 300
 800 REM :REST FOR VALID ALLOPHO
NE ENTRY
 805 IF LEN (I$)=2 THEN LET I$=I
$+" "
 810 FOR I=1 TO 64
 830 IF I$=Z$(I) THEN GOTO 950
 840 NEXT I
 900 REM :USER ENTERED INVALID D
ATA
 910 PRINT "***INVALID ENTRY***"
 920 GOTO 315
 950 REM :USER ENTERED VALID ALL
OPHONE"
 960 IF P>LENGTH THEN GOTO 900
 970 IF M=0 THEN GOTO 1100
 980 IF L>LENGTH-1 THEN GOTO 900
 990 LET X=S(P)
1000 FOR J=P+1 TO L+1
1010 LET Y=S(J)
1020 LET S(J)=X
1030 LET X=Y
1040 NEXT J
1050 LET L=L+1
1100 REM :NOW PUT ALLOPHONE INTO
 STRING AT POS ?
1110 LET S(P)=I
1120 IF L<P THEN LET L=P
1130 LET P=P+1
1140 LET M=0
1150 GOTO 300
2000 REM :DISPLAY ALLOPHONE STRI
NG
2010 CLS
2020 PRINT
2030 IF P=1 THEN PRINT "->";
2040 FOR I=1 TO L
2060 PRINT Z$(S(I));" ";
2070 IF I=P-1 THEN PRINT "->";
2080 NEXT I
2090 PRINT
2105 IF M=1 THEN PRINT "***INSER
T MODE***"
2110 RETURN
3000 REM :SECTION TO MAKE BOARD
PRONOUNCE PHRASE
3020 FOR I=1 TO L
3050 POKE 8295,S(I)-1
3060 LET R=USR B
3070 NEXT I
3080 GOTO 300
4000 STOP
5000 LET LN=VAL I$(3 TO )
5010 IF I$(1)="L" THEN GOTO 400
5020 IF I$(1)="R" THEN GOTO 500
5030 GOTO 900
```

ALLOPHONE ADDRESSES (Fig.5)

OCTAL ADDRESS	ALLOPHONE	SAMPLE WORD	DURATION	OCTAL ADDRESS	ALLOPHONE	SAMPLE WORD	DURATION
000	PA1	PAUSE	10MS	040	/AW/	Out	370MS
001	PA2	PAUSE	30MS	041	/DD2/	Do	160MS
002	PA3	PAUSE	50MS	042	/GG3/	Wig	140MS
003	PA4	PAUSE	100MS	043	/VV/	Vest	190MS
004	PA5	PAUSE	200MS	044	/GG1/	Got	80MS
005	/OY/	Boy	420MS	045	/SH/	Ship	160MS
006	/AY/	Sky	260MS	046	/ZH/	Azure	190MS
007	/EH/	End	70MS	047	/RR2/	Brain	120MS
010	/KK3/	Comb	120MS	050	/FF/	Food	150MS
011	/PP/	Pow	210MS	051	/KK2/	Sky	190MS
012	/JH/	Dodge	140MS	052	/KK1/	Can't	160MS
013	/NN1/	Thin	140MS	053	/ZZ/	Zoo	210MS
014	/IH/	Sit	70MS	054	/NG/	Anchor	220MS
015	/TT2/	To	140MS	055	/LL/	Lake	110MS
016	/RR1/	Rural	170MS	056	/WW/	Wool	180MS
017	/AX/	Succeed	70MS	057	/XR/	Repair	360MS
020	/MM/	Milk	180MS	060	/WH/	Whig	200MS
021	/TT1/	Part	100MS	061	/YY1/	Yes	130MS
022	/DH1/	They	290MS	062	/CH/	Church	190MS
023	/IY/	See	250MS	063	/ER1/	Fir	160MS
024	/EY/	Beige	280MS	064	/ER2/	Fir	300MS
025	/DD1/	Could	70MS	065	/OW/	Beau	240MS
026	/UW1/	To	100MS	066	/DH2/	They	240MS
027	/AO/	Aught	100MS	067	/SS/	Vest	90MS
030	/AA/	Hot	100MS	070	/NN2/	No	190MS
031	/YY2/	Yes	180MS	071	/HH2/	Hoe	180MS
032	/AE/	Hat	120MS	072	/OR/	Store	330MS
033	/HH1/	He	130MS	073	/AR/	Alarm	290MS
034	/BB1/	Business	80MS	074	/YR/	Clear	350MS
035	/TH/	Thin	180MS	075	/GG2/	Guest	40MS
036	/UH/	Book	100MS	076	/EL/	Saddle	190MS
037	/UW2/	Food	260MS	077	/BB2/	Business	50MS

DEVICE CODES

E1 AND E2	C B A	OUTPUTS 1 2 3 4 5 6 7 8	PIN NO.
1	X X X	1 1 1 1 1 1 1 1	15
0	0 0 0	0 1 1 1 1 1 1 1	14
0	0 0 1	1 0 1 1 1 1 1 1	13
0	0 1 0	1 1 0 1 1 1 1 1	12
0	0 1 1	1 1 1 0 1 1 1 1	11
0	1 0 0	1 1 1 1 0 1 1 1	10
0	1 0 1	1 1 1 1 1 0 1 1	9
0	1 1 0	1 1 1 1 1 1 0 1	8
0	1 1 1	1 1 1 1 1 1 1 0	7

73, W4GHV & K5XY

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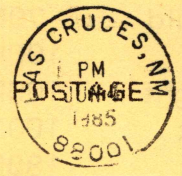
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